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What it's doing and how to control it



MOUNTAIN PINE BEETLE IN FRONT RANGE PONDEROSA PINE:

What It's Doing and How to Control It

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Mountain pine beetle is currently in outbreak status in Rocky Mountain ponderosa pine stands. Much of the cause is probably related to the presence of extensive areas of susceptible forest. What to do about it depends on the objectives of the landowners or land managers. Combined programs using all suitable control methods are proposed.

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Ponderosa pine stands in the Front Range of the Rocky Mountains have a long history of mountain pine beetle infestations, and we are currently in the throes of a major outbreak. Several hundred thousand trees are being killed by beetles every year, and the end is not in sight. Public concern is high, and government agencies and citizens' groups alike are attempting to reduce the impact of the beetle outbreak by whatever means are available.

We have prepared this report to describe — as best we can — the conditions surrounding the current situation, and to suggest some practical means for prevention and control of beetle-caused tree losses. First let us briefly discuss some of the considerations:

1. What are some of the reasons for the current bark beetle outbreak?

Two main things are required — a supply of insects and a supply of suitable host material. The beetles are ever present, but they only build up to outbreak proportions in stands in which most of the trees are at least 6 inches diameter at breast height or larger, and there is at least some overcrowding. Many of the pine stands in the Front Range are now in this category; hence, there is an abundance of suitable host material.

2. What can we expect to happen if nothing is done?

Where nothing is done to help get the outbreak under control, we can expect losses to continue more or less at current levels. In general, the beetles kill trees in patches; patches will increase in size, but some stands and parts thereof will escape. Some areas not yet infested will be attacked; and the outbreak will subside in some of the heavily hit areas. Natural controls — primarily extreme low winter temperatures — may decimate local insect populations at irregular, often long intervals. The supply of suscepti-

ble host material will still be there, however, and infestation will recur in time.

Both trees and beetles have persisted for thousands of years, and there is no reason to expect total devastation of the ponderosa pine forests. Locally, however, tree killing has been, and will continue to be, severe in overstocked and marginal stands.

How the Beetles Operate

Mountain pine beetles have a 1-year life cycle. Adults fly and attack new trees in midsummer, usually July 15 to September 15. The beetles carry with them a bluestain fungus that hastens death of the tree. Successfully attacked trees die almost immediately, but do not fade for nearly a year. The beetles overwinter as larvae, and complete their development the following spring and early summer.

As we have noted, mountain pine beetles usually kill ponderosa pines in groups, rather than scattered single trees throughout the stand. These groups enlarge as subsequent generations of beetles continue the infestation, or new adjacent groups may be attacked. Groups may include from 2 or 3 to 100 or more trees. Infestations do not usually begin in trees under 6 inches diameter breast height (d.b.h.), but smaller trees may be killed when an infestation is underway.

Management Objectives

The objectives of the land manager are critical to bark beetle control. They range from keeping every tree healthy and green, such as in a yard, to "letting nature take its course," or essentially no management whatsoever. Either, as well as intermediate objectives, may be reasonable under different circumstances. The manager must select an economic level at which to start some action; in other words, he must decide "How much loss can I tolerate?"

Approaches to Beetle Control

The first steps are to understand what to expect from the infestation, and to determine the

management objectives. Knowing these two things, the manager can devise a rational plan.

Beetles do not respect land ownership lines. Dedicated work on one ownership may be wasted if infested neighboring forest is neglected. Thus it is usually necessary that work done be on a "community" basis. Individual, highly localized efforts — except in the case of individual tree protection, which we will consider shortly — are doomed to failure. In addition, it is most practical to begin a program before an outbreak has had much of a chance to get underway. Beetle populations are especially difficult to handle when numerous large groups of trees are becoming infested annually.

Four general approaches can be utilized: (1) direct control, using standard methods of burning (where applicable) or treating infested trees with an insecticide; (2) logging infested trees; (3) preventive silvicultural treatment; or (4) individual-tree protection.

The first two of these are well known and being generally used. Although the last two are not yet commonly employed in the Front Range, they may be extremely useful. Let us consider each separately, and then suggest how they can be combined in a "pest management" program.

Direct Control

Direct control is probably the best known and has been the most widely employed method of bark beetle control in the Front Range area. Insecticides (e.g. ethylene dibromide, lindane, cacodylic acid) are generally used, although in a few instances infested trees are felled, piled, and burned.

The purpose of direct control is to destroy beetles in currently infested trees before they can emerge and attack green trees. For direct control to be successful, all elements of the operation must be done properly: (a) delineating the area to be treated; (b) spotting infested trees; and (c) doing the actual control work — killing the beetles. A breakdown in performance of any of these three steps may mean that the project will fail. If an insufficient area is included, if infested trees are missed in spotting, or if trees are improperly treated, beetles will continue to develop and jeopardize the success of the operation.

Logging Infested Trees

This simply means harvesting currently infested trees. Beetles are then destroyed as a part of the sawmilling process. Obviously area delineation and spotting must be done as carefully in this approach as in direct control. Cutting infested trees for firewood is another aspect of the same approach. Infested material must not be left in the woods or in the woodpile

when the beetles emerge, of course, or control benefits will be lost. Infested material should be burned or treated prior to beetle flight, which begins about July 15.

Silvicultural Control

Silvicultural control or "getting stands under management," has been recommended as a means to minimize bark beetle activity, but has been used little in the Front Range. The rationale behind this approach is to change stands that are in a "susceptible condition." In practice, this means thinning dense stands of trees of sufficient size to support an infestation.

In the northern Black Hills, outbreaks usually develop in those portions of stands with basal areas over 150 ft²/acre, and with most trees over 8 inches d.b.h. Thinning to maintain stand density well below 150 ft²/acre has been effective in suppressing a bark beetle outbreak in portions of the Black Hills where this practice has been carried out. Stands are thinned to a low enough density that they will not grow to 150 ft² before the next thinning.

In the Front Range, uniform pine stands are uncommon, but otherwise their characteristics are often similar to those in the Black Hills. Crown canopies are often closed or nearly so. Growth has slowed down. Thinning to open stands and stimulate growth should be as helpful in the Front Range as in the Black Hills as a deterrent to bark beetle outbreaks. Dense portions of stands 60 to 120 years old with an apparent potential for infestation (pure ponderosa pine or nearly so, most trees 6-8 inches d.b.h. or larger) will probably benefit from thinning to about growing stock level (GSL) 80. These thinning techniques are described in a Rocky Mountain Forest and Range Experiment Station research publication,¹ and are also discussed in a more general way in a paper currently in press.² Private landowners can consult local State Forest Service foresters for assistance in planning the proper thinnings.

There are two cautions to consider with regard to thinning: **First**, thinning obviously has no application in "fringe" areas, in which the trees may already be widely spaced. These are the areas where the forest meets the grassland, and both types of vegetation compete for dominance over long periods of time. Moisture is

¹Myers, Clifford A. *Field and computer procedures for managed-stand yield tables*. USDA Forest Service Research Paper RM-79, 24 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado 1971.

²Myers, Clifford A. *Multipurpose silviculture in ponderosa pine stands of the montane zone of central Colorado*. USDA Forest Service Research Paper (in press). Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

often critical for the trees, and during these periods they may be severely weakened. These stands are often susceptible to attack, and do suffer severe losses under certain outbreak situations. Direct control and/or salvage is the only solution in these areas.

Secondly, it should also be recognized that the beneficial effects of thinning may be reduced if the thinned area is small and is surrounded by unmanaged forest in which an outbreak is permitted to go unchecked.

Individual-Tree Protection

We hope that research presently underway will soon enable us to recommend techniques to protect individual trees. This approach involves spraying a toxic material on the tree trunk to prevent beetles from attacking successfully. Such an approach will only be useful in situations where high value of individual trees justifies the expense of application. Currently, no insecticides are registered for this preventive type of use on live trees.

Techniques of the Future

Researchers around the world are working on a number of unconventional approaches to bark beetle control, some of which may, in time, become practical. These include use of repellents, or anti-feeding compounds, "sex attractants" (pheromones), manipulation of parasites, predators and insect diseases, and the like. At the present time none of these approaches is sufficiently reliable nor economical for practical application.

An Integrated Program

With the following integrated program, combining currently available direct and silvicultural control techniques, the land manager can greatly reduce losses to bark beetles. The program is based on two assumptions: (1) the manager wants to hold losses to a minimum, and (2) he treats a sufficiently large area to minimize serious beetle inflight from outside the area being treated. If he is willing to accept some stand depletion, a less vigorous program may be acceptable.

It will probably take 3 or more years to set up a management program to minimize losses caused by bark beetles if an infestation is underway. Tasks and an estimate of time necessary to accomplish them are as follows:

Year	Tasks
1	<ul style="list-style-type: none"> a. Determine boundaries of area to be included, and arrange for handling it as a unit. b. Salvage and/or direct control infested trees over entire area. c. Locate areas in which thinning is needed; begin thinning to about Growing Stock Level 80.
2	<ul style="list-style-type: none"> a. Continue salvage and/or direct control. b. Finish thinning.
3	Salvage and/or direct control.
4+	Maintain surveillance. Salvage and/or direct control, if needed.
10+	Reevaluate treated area. Thin when necessary to maintain low stand density.

Discussion

Proper implementation of a program should markedly reduce losses caused by bark beetles. However, it must be recognized that there is no way to reduce these losses cheaply, unless salvaged and/or thinned trees can be sold. The renewed interest in firewood in the Front Range will work in favor of bark beetle control, provided care is taken to prevent the spread of beetles from firewood to uninfested pines.

An important point is that the land manager must consider the bark beetle situation as a part of a larger overall picture, including **all** relevant biological and economic factors. For example, bark beetle control might not be advisable in a stand heavily infected with dwarf mistletoe, where the long-term outlook for the stand is bleak irrespective of the beetle problem. The land manager must always be alert to these related considerations.

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Technical assistance is available to help land owners and managers with forest pest problems. Contact your nearest USDA Forest Service or State Forest Service office for further information. When using insecticides, read and follow the instructions on the insecticide container label. Use only according to instructions.